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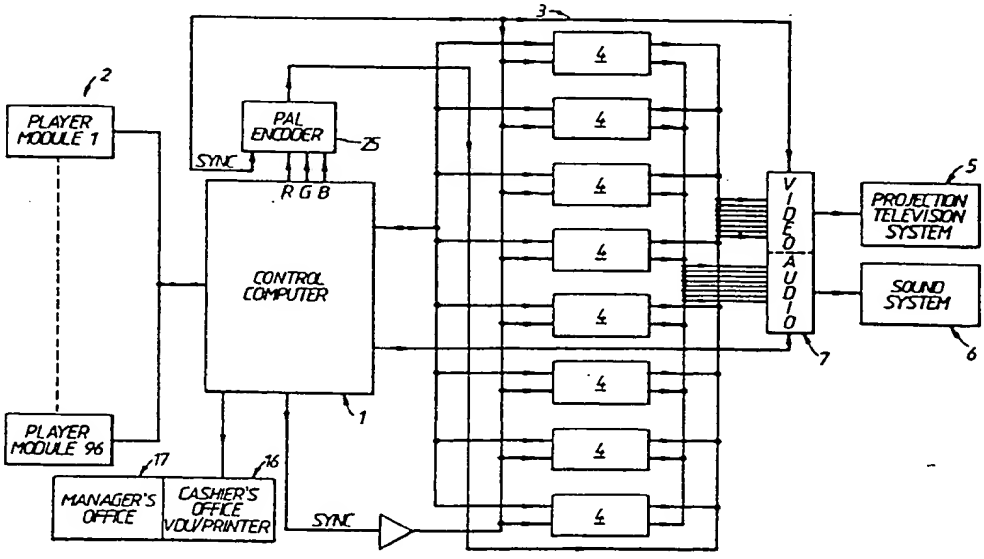

(57) Abstract

An interactive system comprises a plurality of laser vision disc players (4) under control of a control computer (1), itself under control of a plurality of user modules (2) by which data may be entered into the control computer (1) to affect the control of the disc players (4). In one embodiment, the disc players store segments from which a plurality of events may be constituted and displayed by a projector system (5). Reaction tests are given to the users and their responses are recorded by the computer (1) which then determines the selection of event segments in dependance upon the responses. In a modified embodiment, the disc players store audio commentary segments and the computer creates corresponding visual event segments for display.

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INTERACTIVE SYSTEMS

This invention relates to interactive systems and is particularly concerned with interactive video systems, especially for implementing games or other competitive events or situations which can be visually represented.

According to one aspect of the invention, there is provided an interactive system for producing any one of a plurality of events in dependence upon users' responses, characterised in that the events are composed of a sequence of event segments, and the system comprises:

a plurality of random access storage means for storing a plurality of said event segments from which any one of a plurality of events, having different outcomes, may be constructed;

means for reproducing selected segments from the storage means whereby the constructed event may be perceived by the users;

control means for controlling the storage means to select the sequencing of event segments to be perceived; and

a plurality of user terminals for coupling to the control means to provide data to said control means, the control means being responsive to said data to influence the selection of event segments such that the perceived event is a function of the data from the user terminals.

Preferred embodiments use disc drives, e.g. video storage means, for storing said event segments as video and/or audio event segments. In one embodiment, computer graphics provides a controllable visual sequence of event segments, whilst the storage means provides corresponding audio event segments as a commentary. In another embodiment, a plurality of video storage means provides video, and corresponding audio, event segments for display by a video display means.

In one preferred embodiment, the system provides a computer controlled, interactive, large-audience video game where players at individual user terminals compete

with each other by means of the manner in which they operate their terminals in order to determine the outcome of an event, e.g. the finishing order of a race such as a horse race or motor race, displayed by video display means. The users are provided with challenges requiring a response by users at their terminals, such responses determining the image selection.

In such an embodiment, provision may be made for accepting bets at the terminals and for allocating betting odds to individual terminals. The control means may then calculate, from the odds and the stakes, the total outgoings for the projected outcomes of the event. The control means can be designed to modify the challenges as necessary to ensure a predetermined profitability, i.e. margin between the total of the stakes and the total outgoings.

Thus according to another aspect of the invention, there is provided a computer system for use in the system of the first aspect and comprising means for receiving data from a plurality of user terminals, means for producing video signals to operate video display means to display data to users calling for responses at their user terminals, means for sending to each user terminal data defining the betting odds to pertain to that terminal (and thus a 'competitor' in the event being or to be displayed), means responsive to stakes received from the terminals to calculate outgoings corresponding to a particular event outcome, means for calculating, using data received in response to the display of said video signals, an event outcome and for producing control signals to control video storage means accordingly to influence the images sequence provided by said storage means.

The system may be arranged to modify the display of data to users calling for user response in the case that a calculated outcome provides outgoings having a predetermined relationship to the total stakes in order

to provide for new user responses to give a new outcome and hence a different level of outgoings. In this way, it can be arranged that, whilst users determine the outcomes of events, excessive winnings can be avoided by modifying outcomes as a result of modified challenges to the users.

Preferably, responses are not analysed terminal by terminal but in groups, so that the response used to determine outcome is the average of that at a set of terminals. In embodiments having a large number of players, there are means for detecting and recording the individual players' responses and times of response and the control means is arranged to scan the recording means, whereby real time scanning of the responses by the control means is avoided.

In order to provide life-like representation of events and to provide the ability to change the outcomes of events, a bank of laser disc machines may be used to receive video discs carrying the various images which will be selected to create an event.

Thus, according to another aspect of the invention, there is provided a video system comprising a plurality of laser-vision video disc players each arranged to receive a video disc of pre-recorded visual sequences and a multi-user control computer for selecting sequences from said bank, the computer being so arranged that data received from the users is employed by the computer to calculate a desired video sequence created by control signals from the computer to said bank.

The user terminals themselves, for a betting usage of the system, may comprise identification means to display to a user the 'competitor' allocated to the terminal and to display data such as the odds for the user, input means by which the user can respond to request for responses, means for receiving the values of stakes made by the user, and means for printing the results for the user of his bet.

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skill-related challenges determine the order in which the winning horses conclude the race. The race they watch will involve real horses accompanied by 'famous' voice commentary. In all respects it will appear that they are watching the live transmission of an actual race relayed to them by television onto a cinema-size screen. In fact they will be television images but the sequence of images will be selected by the system. At no time will the participants feel they are playing a video game controlled by a programme; rather there will be all the excitement and anticipation of an unpredictable result. Indeed, in that the players actually determine the outcome of every race, each race is uniquely 'live'.

Each member of the audience communicates with the game through his own computer-linked player-module 2 which may comprise (Figure 2):

i) a series of group assignation lights 20. These allow each player to identify with a particular race entrant;

ii) a series of multiple-choice buttons 21;

iii) a visual display screen 22 which allows each player to receive discrete information (e.g. 'Odds', 'Stake', 'Winnings'. etc);

iv) a magnetic card reader 23. This is operated to read token cards of different values (e.g. '£5, '£2', '£1', £0.50') to allow the player to place his bet; and

v) a print-out unit 24. This gives the player a statement of his winnings which he can exchange for money at the cashier's office.

The game is managed by a central control computer 1 which not only interacts with upto, for example, ninety six player-modules 2 but also controls a laser-vision video projection arrangement 3 via a multiplexed, asynchronous, data communication link. In this embodiment the system can be programmed, if desired, to guarantee a profitable return to the operators regardless

of the outcome of any particular race. Thus, not only is there a fast-reference facility available from a plurality of laser-vision disc players 4, but computer 1 is able to calculate profitability and 'talk' to the laser system.

In order to calculate profitability, the computer ascertains:

(i) the number of players associated with each horse;
(ii) the odds given to each player;
(iii) the stakes placed by each player; and
(iv) aggregate response times to player reaction tests which determine the finishing order of the first three horses.

Given this information the computer can adjust how many reaction-time tests are necessary in order to guarantee the house a profitable return on the race.

The projection arrangement 3 comprises a bank of laser-vision video disc players 4, the large-screen video projector 5 with stereo sound system 6, and an audio and video matrix interface 7 coupling the disc players 4 to the projection system 5 and sound system 6.

A PAL encoder 25 supplies graphics data from the computer to the interface 7, and encoder 25, disc players 4 and interface 7 are controlled by a computer generated sych signal denotes SYNCH. Taking advantage of the fast-retrieval times available with video disc machines, it is possible to edit together pre-recorded visual sequences by computer control at speeds which allow the audience to see a continuous film narration. By classification of short film sequences into category types, it is possible for an audience to interact with the computer and to be responsible for the direction the film narrative takes on the screen.

The game begins with each player either selecting or being assigned a horse. By this process the audience is divided into a number of competing groups ("SETS") of approximately equal size which match the number of horses

(e.g. six) in the race. The composition of each SET (i.e. the particular players assigned to each horse) is noted by the controlling computer 1.

The game then continues with the computer 1 generating a series of multiple-choice questions which are supplied to a PAL encoder 25 from the R, G, B outputs of the computer. The output of the encoder passes via a computer text and graphics line to the interface 7 for mixing with the video signals so as to be displayed on the large-format screen. The computer records the successful results of each player keyed in at his module 2 and at the end of the sequence informs the players individually, via their player-module display screens, of the gambling odds offered to each of them. That is, the more successful group of players receives better odds than the less successful ones.

Each player now decides how much he wishes to gamble on the odds offered and places the appropriate value of tokens into his player-module. This is noted by the control computer 1.

Onto the large screen is now projected the pre-race scenes from the race-course: the crowds, the tick-tack men, the horses in the paddock, the line-up at the starting gate and the first few minutes of the race. Concurrent with this montage of shots, an irregular sequence of reaction-test signals generated by the computer is super-imposed on the screen by way of encoder 25 and interface 7. The players have to respond by pressing the appropriate button on their player-modules 2. For example, various coloured marks may appear at random on the screen and correspondingly coloured buttons on the player modules are monitored by the computer to determine the correctness and timing of the players' reactions.

Each individual player's reaction-time is recorded by the computer and after each test the computer averages the response times for each SET (a SET being a group of

players identified with the fortunes of a particular horse in the race). When a pre-determined series of such tests have been completed, the computer aggregates the overall performance of each "SET" and assigns an order to them from fastest to slowest. This assigned order of performance determines the finishing order of the first three horses in the race.

Once the computer settles upon an acceptable result for the race, it calls up this 'particular' race from the laser disc stores. For example, if six horses are racing, then, by simple permutation, there are one hundred and twenty possible ways in which the first three horses can pass the finishing post. (e.g. 6 x 5 x 4). All of these filmed endings are held in the disc stores ready for projection as required.

The race concludes with scenes in the saddling enclosure, of the horses and of the crowd, whilst on each player-module the print-out unit produces a winning slip for each successful player. These can be exchanged for money at the cashier's pay-out desk.

The computer contains a program to determine these functions and which is divided into a number of modules or routines which are shown diagramaticaly in Figure 3. A module 8 is coupled to the player modules 2 for the allocation of player-modules into SETS.

Computer-text generation of a series of multiple-choice questions is accomplished by a module 9 coupled to the video projector 5.

A module 10 processes the players' answers and allocates ODDS to each player-module.

The recording of the STAKES placed by each player is effected by a module 11.

In order to select race-sequences for the first two or thee minutes of the race whilst the reaction-time tests are being conducted, a module 12 is provided, coupled to a laser vision control module 13 which controls access to the filmed race sequences which are

held in the laser-vision disc stores and initiates the chosen finishing sequence to the race. A module 14 is coupled to receive data from module 8 and the player modules 2 to generate the randomly-sequenced reaction test signals and to average the response times of all the players within each SET after each reaction-time test.

The analysing of the financial implications of any particular race ending in terms of the ODDS and STAKES involved at each player-module, and the operation of a YES/NO gate which secures a profitable return to the operator, is accomplished by a gate module 15 receiving data from modules 8, 10, 11 and 14.

Messages to the player-module print-out units and to print-out units in cashier's office 16 and manager's office 17 are controlled by a 'race results' module 18.

Finally, module 19 controls error detection through-out the system, including faulty data and equipment failure.

The gate module 15 will now be further described.

It monitors all the relevant financial data in the system and only allows the final race sequences to be selected when a profitable return to the equipment operators is assured. In system terms the eventual finishing order of the horses is determined by the collective response of each SET of players to a series of reaction-time tests. The function of the gate module 15 is to analyse the financial implications of any finishing order in terms of the ODDS and STAKES involved and to see whether such a finishing order produces an acceptable return to the commercial operator.

It achieves this by operating a YES/NO gate whose threshold is set at 0.2x when:

x = the total sum of the players' stakes; and,

y = the total outgoings involved if a particular race ending is allowed to occur.

Thus the gate's threshold formula is set at:

x - y equals not less than 0.2x.

The calculation of 'y' is achieved by a simple process of multiplication and addition, where the financial situation pertaining at every player-module for a given race-ending is discovered by multiplying the 'ODDS' by the 'STAKE' by a 'WEIGHTING FACTOR' which derives from the finishing order. The conclusion to a race would be financially acceptable if x minus y equals more than 0.2x. In that case the gate module would allow this race-ending to take place.

If x minus y does not meet the threshold required the gate module would stay closed. It would also instruct module 14 to run additional player-response tests until an acceptable finishing order for the race was offered. If, after a further number of player-response tests, the gate module remains closed, then the module is programmed to adjust the THRESHOLD downwards, thus reducing profitability to the operator. The detailed operation is as follows in one example.

Six, randomly-generated, response-time tests are given to the players. After each test the computer averages the response time for each SET and this information is fed to the gate module. After each subsequent test the gate modulate aggregates the progressive score for each SET. After the aggregate of six tests has been recorded in the gate module, the race ending denoted by these results is analysed to check its financial acceptability. If the gate module remains closed, it erases its aggregated data and offers the next and every subsequent response-test result to the gate module until an acceptable one is recognised. If after six such subsequent tests have been completed and the gate module still remains closed, the THRESHOLD FACTOR is progressively reduced until x equals y.

A further embodiment is a simplified version of Figures 1 to 3, in which gating of results is not employed, so that the race endings are determined strictly by the players' responses. The modules or

routines then used by the computer 1 would be as used for the system Figure 4 which is yet a further embodiment now to be described.

Figure 4 is a block diagram of an interactive video system for a few players, e.g. three players, based again on recorded horse-racing images, but using two laser-vision disc players 4 under computer control, i.e. a scaled-down version of the embodiments of Figures 1 to 3.

It comprises three player modules 2 coupled to the user port of an Acorn BBC module B computer 1 (6502 based) by an interface 30. One of modules 2 and the interface 30 are shown in more detail in Figure 5. The computer 1 is coupled to a disc drive 31 on which is provided the software which, together with the hardware and firmware of computer 1, provide the various modules or routines to control the system. The computer 1 has a serial RS 423 interface coupled by a second interface module 32 (shown in Figure 6) to two Philips laser-vision players 4 (VP 831) the audio outputs of which are coupled to a loadspeaker 33 by an audio mixer 34 (Figure 7) and the video outputs of which are coupled by a video amplifier and mixer 35 to a video projector 5. A cassette output of the computer 1 is coupled to the mixer 34 by a cassette player 70, the computer controlling the cassette player motor, whilst the cassette used contains a recording of background noises for the event to be produced, e.g. a continuous sound of hoof beats, which is to continue without stop during changing of the segments of the event. PAL encoder 25 is included to transmit computer generated text and graphics to the mixer 35 and there is a separate synch generator 27 to control the system.

Figure 5 is a block diagram showing the circuitry of one player module and the interface 30 (the parts shown dotted are used only in the embodiment of Figure 8). The player module 2 comprises three double pole switches 36 which, in use, may be labelled with colours,

e.g. red (R), blue (B) and white (W). The players watching an event are intended to look for coloured markers appearing, apparently at random, on the video display 5 and to press the corresponding one of their switches as soon as possible.

In order to decode the switch presses, the interface has nine latches 37 one for each switch 36. The three latches 37 for one player module are intercoupled to provide two outputs 38 to tristate switches 39 (type 74LS244) the outputs of which are coupled to terminals PB0 to PB5 of the user port of the computer 1. The two outputs define four states, i.e. no switch presses and the three different key presses. In order to read out the data to the user port at controllable times, the tristate latches are enabled by way of inverters 40 controlled by a latch 41 enabled and disabled by NOR gates 42 and 43 receiving control signals from PB6 and PB7 configured as outputs by and from the computer. Gate 43 also provides a control signal CTRL to the interface of Figure 6.

Figure 6 shows the interface between the RS423 input/output of the computer 1 and the laser vision players. Level converters 44 (type DS88LS120) receive the RS423 DATA and RTS signals and supply them to a first of the players 4 via elements 45, 49, 47 and 51 and to the second player 4 via elements 46, 50, 48 and 52. Elements 49 to 52 are provided by a line driver 53 of type DS3691 and elements 45 to 48 are part of a set 54 of schmitt trigger circuits of type 74LS241. Line driver 55 supplies the DATA and CTS inputs to the RS423 input/output from four further schmitt trigger circuits 56 to 59 of set 54. Elements 45, 47, 56 and 58 are controlled by signal CTRL via an inverter 60 and elements 46, 48, 57 and 59 are controlled by a non-inverting element 61. A level converter 62 receives DATA and CTS signals from the first player 4 and supplies them to elements 56 and 58 and, similarly, level converter 63

supplies DATA and CTS signals from the second player 4 to elements 57 and 59.

Figure 7 shows the audio mixer 34. It comprises an amplifier 64 (type 741N) receiving the audio signals from the video players and cassette player through variable resistance paths. A switch 65 enables the amplification to be altered. The output of amplifier 64 is coupled to the loudspeaker 33 via an audio amplifier 66.

The computer software provides various of the functions indicated in Figure 3 as follows:

(i) generation of random reaction tests;

(ii) assessment of responses and their response time;

(iii) selection of video segments for the pre-race period and for a first section of the race; and

(iv) selection of video segments for the final section of the race in dependence upon the assessment at (ii).

Additionally, there may be provision to selet video segments in a middle section of the race in dependence upon intermediate assessments of responses so far. If desired, odds may also be allocated to players and results calculated in dependence upon a nominal stake. A gate module as described previously would not be required in this embodiment. As already indicated, the initially described embodiment may also be simplified to operate as just described above, including functions (i) to (iv).

Figure 8 shows a modification of Figure 4 in which the video image segments are generated by the control computer 1 as R, G, B and synch signals supplied to a colour synthesiser 37, available from Interactive Research of Ascot, England as a model referrred to as 'Peacock'. It is coupled as well to the interface 30, as shown in dotted lines in Figure 5. Its function is purely to increase the number of colours which can be displayed and so may be dispensed with if the colour facilities of the computer 1 are considered sufficient.

The computer graphical images comprise a background, including a race track rail, and three graphics representations of horses with their legs being shown in a number of successive positions to indicate motion. These representations are superimposed on the background. The background is caused to scroll to the left to indicate motion of the horses to the right whilst the relative positions of the horses are adjusted according to current decisions by the computer of the eventual outcome determined by the players' responses to coloured markers also superimposed at random times on the video signal. The positions of the horses may be calculated in a random manner during the body of the race, if desired, only the final stages being determined by player response.

In order to provide a smooth, logical concatenation of the images of the horses, a control algorithm is used which also acts as a pointer to the necessary components of a 'shooting-script' to produce the large number of recorded race sections required of the system. Further subsidiary activities of the control computer include the generation of the reaction test stimuli or other knowledge-based tests, text information on the race and the arithmetic processing of players' odds and winnings in the game.

By using simple computer graphics it simulates the imagery of a televised horse-race during which three players match their skills in 'speed of reaction tests' from visual stimuli generated by the computer. Ultimately the player with the best performance in the tests sees the horse with which he/she is associated cross the finishing line first with the positions of the other two horses reflecting the differences in the players' performances in the tests. The simple two-dimensional computer graphics employed represent the view as seen by an imaginary 'roving-eye' television camera moving parallel to the course. The end of the

race is signalled by the winning horse crossing the finishing line. At this point the action is frozen on the display screen in the manner of the familiar television 'freeze-frame'.

The system also incorporates a recorded sound commentary (with suitable background effects) which is precisely synchronised to the movements of the horses on the screen. The method to be described is to record a large number of short, tightly-scripted, commentary snippets on two Philips laser-vision discs which are then randomly accessed as required by the control computer when replayed in the Philips VP831 laser-vision disc players 4.

Using two laser-vision players ensures that there is a substantially continuous commentary. Background 'hoof-beat' effects are uninterrupted throughout the race. This is simply achieved by obtaining these effects from the audio-cassette player 26 which is started and stopped automatically at the correct points. The cassette recorder output is mixed at 34 with the commentary from the laser-vision players 4 and the result forms the accompanying sound channel to the computer graphics display. Items 30, 32 and 34 are as already described with reference to Figures 5, 6 and 7.

In order to produce the synchronised commentary outlined above an algorithm is used which always ensures that a matching piece of commentary to the graphics is accessed from the laser-vision players 4. This commentary fragment precisely reflects the movement and position of the three horses at any moment. A second function of the algorithm is its use in the development of suitable software graphics segments which are simulations of television images. The simulations enable a commentator's script to be prepared and an actor to record a commentary to each of the many action sequences required and generated by the algorithm. Each commentary segment is given a code number so the algorithm

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positions. Each reaction test takes place during a period of steady motion but at the end of the test the motion changes to one of an acceleration or deceleration step. During periods of steady motion, the 'horses' remains stationary on the screen, but the illusion of motion across the field of view is maintained by the continued 'leg-movements' of the 'horses' and the track railings.

The nature of the steps and the generation of Commentary Code Numbers (CCNs) is now described in more detail. All the steps are of a fixed duration during which one 'horse' moves a fixed distance forward, one the same distance backward, while the position of the third remains unchanged. If a forward move is represented as +1, a backward move as -1, and no movement as 0, the movement pattern of the three 'horses' A, B, and C can be represented as a pattern of three integers +1, -1 and 0. Thus, for example, if A remains steady, B moves forward and C moves backward, this can be represented as (0, +1, -1). There are clearly six possibilities of movement for each step, corresponding to the patterns (+1, 0, -1), (+1, -1, 0), (0, -1, +1), (0, +1, -1), (-1, 0, +1) and (-1, +1, 0).

In a similar manner, the current position of the three 'horses' can be represented as three integers, indicating 'step-units' away from the original position. Thus the origin itself is (0, 0, 0). In order to distinguish movement patterns from position pattetns, movements are denoted by M(0, +1, -1) etc. and positions by P(0, +1, -1). Clearly, after one 'step-unit' from the origin, M(0, +1, -1) will give rise to P(0, +1, -1), whilst M(+1, 0, -1) will give rise to P(+1, 0, -1) etc. Thus after the first 'step-unit' there are six possible position patterns: P(+1, 0, -1), P(+1, -1, 0), P(0, -1, +1), P(0, +1, -1), P (-1, 0, +1) and P(-1, +1, 0).

At the beginning of the second 'step-unit', each of the six movements can be applied to the new position.

To illustrate the possible patterns in the second 'step-unit', suppose that the position at the end of the first 'step-unit' is P(+1, 0, -1). The following table shows what the possible patterns could be:

Positions After Step-Unit 1	Movement At Step-Unit 2	Positions After Step-Unit 2
+1 0 -1	+1 0 -1	+2 0 -2
	+1 -1 0	+2 -1 -1
	0 -1 +1	+1 -1 0
	0 +1 -1	+1 +1 -2
	-1 0 +1	0 0 0
	-1 +1 0	0 +1 -1

Considering now the possible situations after the third 'step-unit'. Suppose, for illustration purposes, that the position exisiting after the second 'step-unit' is P(+1, +1, -2). The possible positions after the third 'step-unit' are as shown below:

Positions After Step-Unit 2	Movement At Step-Unit 3	Positions After Step-Unit 3
+1 +1 -2	+1 0 -1	+2 +1 -3
	+1 -1 0	+2 0 -2
	0 -1 +1	+1 0 -1
	0 +1 -1	+1 +2 -3
	-1 0 +1	0 +1 -1
	-1 +1 0	0 +2 -2

At the start of the first 'step-unit' the choice of which M(a, b, c) function to invoke is made randomly by the algorithm (a, b, c are the integers). It is clear that with each successive step, the number of possible finishing positions (and hence the number of commentary fragments required) increases dramatically. Because of

storage limitations, it is not desirabl in this embodiment to permit random choices of movement for more than a few 'step-units' and the following restrictions on movements are therefore imposed:

(a) Up to 3 'step-unit' movements are generated in a random manner. It can be seen from the above examples that after these 3 movements, the 'horses' would be within +3 and -3 distance units from the origin (0, 0, 0).

(b) One or more previously executed movements are 'negated' (i.e. the 'horse' which moved backwards now moves forward, and vice-versa). After one negated movement the 'horses' will be within +2 and -2 'step-units' (and distance units) from the origin, whilst after two negated movements, the 'horses' will be within +1 and -1 'step-units' from the origin. This is conveniently illustrated by the following example. The table below shows how three movement patterns are selected and applied in a particular case, and how the first two 'step-units' are negated.

Step-Unit Phase	Initial Position	Movement	Final Position
1st	P(0, 0, 0)	M(0, +1, -1)	P(0,+1, -1)
2nd	P(0, +1, -1)	M(+1, 0, -1)	P(+1, +1, -2)
3rd	P(+1, +1, -2)	M(+1, 0, -1)	P(+2, +1, -3)
Negate 1st	P(+2, +1, -3)	M(0, -1, +1)	P(+2, 0, -2)
Negate 2nd	P(+2, 0, -2)	M(-1, 0, +1)	P(+1, 0, -2)

Because the first two 'step-units' are negated, it follows that the final position will always be a 'one-step' position, i.e. a position that can be arrived at after one movement from the origin.

It has been shown how the movement of the 'horses'

at any step can be seen in terms of their starting positions and their movement patterns. If the three 'horses' are A, B and C, the position pattern can be expressed in general terms as $P(P_A, P_B, P_C)$ and the movement pattern as $M(M_A, M_B, M_C)$. (Thus, for example, for a position pattern $P(+1, 0, -1)$, $P_A = +1$, $P_B = 0$ and $P_C = -1$). Clearly, at any particular time, it is true that:

$$P_A + P_B + P_C = 0$$
$$\text{and} \quad M_A + M_B + M_C = 0$$

Hence, P_C and M_C are dependent upon P_A, P_B and M_A, M_B, respectively. It is therefore only necessary to use P_A, P_B, M_A and M_B in the calculation of a Commentary Code Number (CCN). The formula used to calculate CCN is

$$CCN = ((3xM_A) + M_B + 4) - INT (((3xM_A) + M_B + 4) / 5) + ((P_A + 3) x 7 + P_B) x 6$$

where INT (X) means the integer part of X.

By way of example, suppose the initial position is P(-1, +2, -1) and the movement is M(-1, 0, +1), then $P_A = 1$, $+2$, $M_A = -1$ and $M_B = 0$, giving;

$$CCN=(-3 + 0 + 4)-INT ((-3 + 0 + 4) / 5)+((-1+3)x7 + 2)x6$$

$$= 97$$

The CCN formula described is designed such that it will only ever produce CCNs in the range 1 to 255, but also, only 144 of these numbers can ever be produced during the mid-race phase. Unused numbers in this range are assigned to the race-end phase. These numbers are generated as new CCNs during the calculation of players' scores to be used to call-up the appropriate race-end sequence commentary. Constraining CCNs to the range 1 to

255 greatly simplifies the table-driven software (in machine-code) techniques used to look-up the start-frame address of a commentary fragment defined by a particular CCN. (The micro-processor in the control computer is a 6502 type and indirect indexed addressing is used extensively; the CCN parameter being almost directly usable in the Y Register).

The final screen positions of the 'horses' at the very end of the race reflect the scores of the players in the reaction tests, taking account of the relative sizes of the scores achieved. The scale chosen is such that the winner always finishes at a particular point near the right-hand margin of the screen, whilst the 'horse' of a player who has failed to score correctly on any test (as opposed to simply being rather slow to react) would end at a point close to the left-hand margin of the screen. It follows that the commentary must indicate not only the final positions, but also, to be realistic, it must give some indication of the proximity of the horses to one another at the finishing point.

In order to avoid 'horses' changing places during the final sequence the race-ending sequence is as follows:

(a) Calculation of the required final positions of the 'horses' from the players' scores in the reaction tests and calculation of the speed at which they are to move across the screen to achieve their final positions at about the same time.

(b) Calculation of the 'closeness' factors between the first and second 'horses' and between the second and third horses. These quantitites are used in the new CCN formula pertaining to the race-end sequence, and are referred to as CF1, for the 'closeness' factor between the first and second 'horses', and CF2 for the 'closeness' factor between the second and

third horses. CF1 and CF2 may take values of 0, 1 or 2.

These 3 values have the following significance:

'0' is for a 'photo-finish', i.e. the scores of the players' are within a defined tolerance.

'1' is for a small separation; the 2 'horses' involved will converge from their 'starting' positions.

'2' is for a wide separation; the 2 horses involved will diverge from their 'staring' positions.

(c) Movement of the 'horses' into their correct 'starting' positions for the beginning of the race-end sequence. This will actually be the order in which the 'horses' finish. The movement is performed by the 'step-unit' system already described.

(d) Calculation of the race-end CCN as described below.

(e) Calling of the required commentary sequence and initiation of the final movement of the 'horses' culminating in the freeze-frame as the winning post appears.

As was the case for the mid-race CCNs the race-end CCNs are also calculated from current position data and the nature of the movement required. The current position will be the position required for the 'starting' position for the race-end. Once again, this position can be written as $P(P_A, P_B, P_C)$. The nature of the movement is represented mathematically as a function of the 'closeness' factors. The formula for the race-end CCNs is devised to give codes which are not only distinct amongst themselves, but which do not duplicate any of the mid-race CCNs. The formula used is:

$$CCN = 9 - (CF1 \times 3) - CF2 + (X - INT\ (X/4)) \times 9 + INT\ (X/5) \times 183 \quad (\text{where } X = P_A \times 3 + P_B + 3).$$

A final adjustment to four of these CCNs is necessary to prevent duplication of CCNs from the mid-race phase. CCNs 11, 17, 23 and 236, whenever generated by the above formula, are changed to 15, 9, 27 and 240 respectively.

By the processes described, the computer generates thirty seven race-end CCNs and the commentary sequences associated with these CCNs are recorded onto the laser-vision discs. The following table shows all the race-end CCNs and their relationship with CF1 and CF2, and the race-end 'starting' positions.

		Race-end Starting Positions					
CF1	CF2	-1.0.1	-1.1.0	0.-1.1	0.1.-1	1.-1.0	1.0.-1
0	0	x	x	x	x	x	237
0	1	x	9	x	x	227	240
0	2	x	16	x	x	226	235
1	0	x	x	24	33	x	234
1	1	5	14	27	32	224	233
1	2	4	13	22	31	223	232
2	0	x	x	21	30	x	231
2	1	2	15	20	29	221	230
2	2	1	10	19	28	220	229

x = not allowed to exist

When 2 'horses' tie for first or second places, the order in which they appear in the race-end staring positions will always adopt the pattern, A before B, A before C and B before C.

Figure 9 shows a modification to the interface of Figure 5 for the case in which, with a large number of players (as in Figures 1 to 3), the control computer may not be able to scan the players' button quickly enough accurately to measure reaction time. As in Figure 5, three bistable circuits 37 store the players' actions,

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0	0	x	x	x	x	x	237
0	1	x	9	x	x	227	240
0	2	x	16	x	x	226	235
1	0	x	x	24	33	x	234
1	1	5	14	27	32	224	233
1	2	4	13	22	31	223	232
2	0	x	x	21	30	x	231
2	1	2	15	20	29	221	230
2	2	1	10	19	28	220	229

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CLAIMS

1. An interactive system for producing any one of a plurality of events in dependence upon users' responses, characterised in that the events are composed of a sequence of event segments, and the system comprises:

a plurality of random access storage means for storing a plurality of said event segments from which any one of a plurality of events, having different outcomes, may be constructed;

means for reproducing selected segments from the storage means whereby the constructed event may be perceived by the users;

control means for controlling the storage means to select the sequencing of event segments to be perceived; and

a plurality of user terminals for coupling to the control means to provide data to said control means, the control means being responsive to said data to influence the selection of event segments such that the perceived event is a function of the data from the user terminals.

2. A system according to Claim 1, wherein the storage means comprise disc drives.

3. A system according to Claim 2, wherein the disc drives are laser disc players.

4. A system according to any one of the preceding claims, wherein said event segments comprise video material.

5. A system according to any one of the preceding claims wherein said event segments comprise audio material.

6. A system according to Claim 5, wherein the reproducing means comprise audio material reproducing means.

7. A system according to anyone of the preceding claims wherein the reproducing means comprise video

display means.

8. A system according to Claim 7 when appended to Claim 6, wherein the control means comprise means for producing event segments as graphic images for display by the video display means.

9. A system according to Claim 8, wherein the event segments comprising audio material have accessing addresses on said storage means, and the control means has means for producing said accessing addresses as a function of said graphic images.

10. A system according to Claim 9, wherein the graphic images involve an event containing n (> 1) 'competitors', and the means for producing said accessing addresses comprises means for monitoring the relative positions P and relative movements M of the n 'competitors' at successive steps and for producing said addresses as a function of the positions P and movements M.

11. A system according to Claim 10, wherein the sum of the values of P equals zero and the sum of the values of M equals zero and said function is a function of the P and M values for (n - 1) 'competitors'.

12. A system according to any one of the preceding claims, and comprising means for presenting the users with data, the control means being arranged to determine the selection of event segments in dependence upon the response of the users at their terminals to the presented data.

13. A system according to Claim 12, when appended to Claim 7, wherein the presenting means comprises means for presenting reaction tests by way of the video display means.

14. An interactive video system comprising:

a) video display means;

b) video storage means for storing for display by said video display means a plurality of video images from which an event can be built up, having

a plurality of alternative outcomes;

c) control means for controlling the storage means to select the sequencing of images of the storage means; and

d) a plurality of user terminals for coupling to said control means to provide data to said control means;

the arrangement being such that the control means is responsive to the data from said terminals to influence the selection of the image sequencing, whereby the course of the displayed event is a function of the data from the user terminals.

15. A computer system for use in a system according to any one of the preceding claims and comprising means for receiving data from a plurality of user terminals, means for producing video signals to operate video display means to display data to users calling for responses at their user terminals, means for sending to each user terminal data defining the betting odds to pertain to that terminal (and thus a 'competitor' in the event being or to be displayed), means responsive to stakes received from the terminals to calculate outgoings corresponding to a particular event outcome, means for calculating, using data received in response to the display of said video signals, an event outcome and for producing control signals to control video storage means accordingly to influence the image sequence provided by said storage means.

16. A system according to any one of Claims 1 to 14, wherein the control means comprises a computer system according to Claim 15.

17. A video system comprising a plurality of laser-vision video disc players each arranged to receive a video disc of pre-recorded visual sequences and a multi-user control computer for selecting sequences from said bank, the computer being so arranged that data received from the users is employed by the computer to

calculate a desired video sequence created by control signals from the computer to said bank.

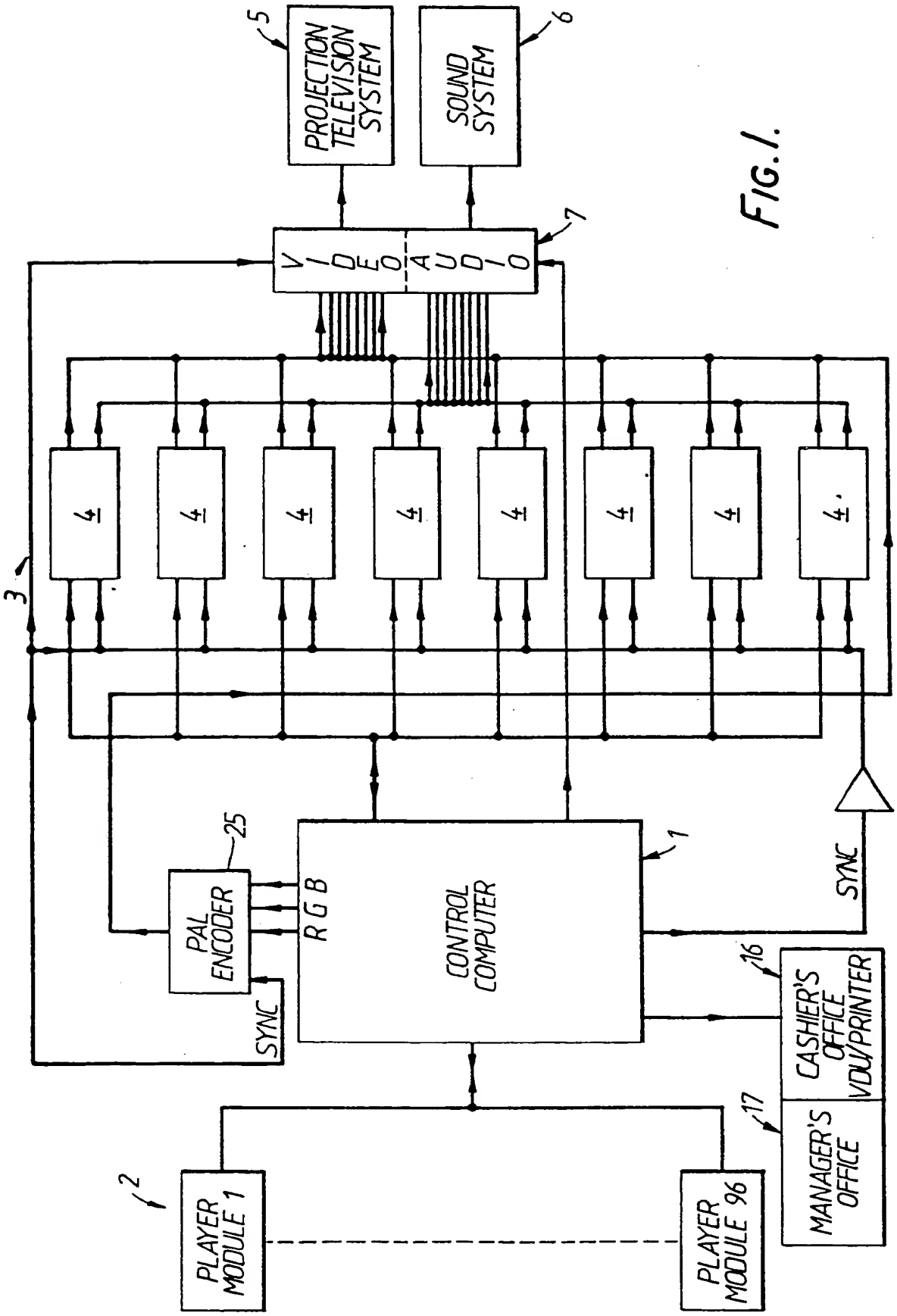
5
PROJECTION TELEVISION SYSTEM
6
SOUND SYSTEM
7
VIDEO AUDIO
4
4
4
4
4
4
4
4
3
25
PAL ENCODER
R G B
SYNC
CONTROL COMPUTER
1
SYNC
16
CASHIER'S OFFICE VDU/PRINTER
17
MANAGER'S OFFICE
2
PLAYER MODULE 1
PLAYER MODULE 96

FIG. 1.

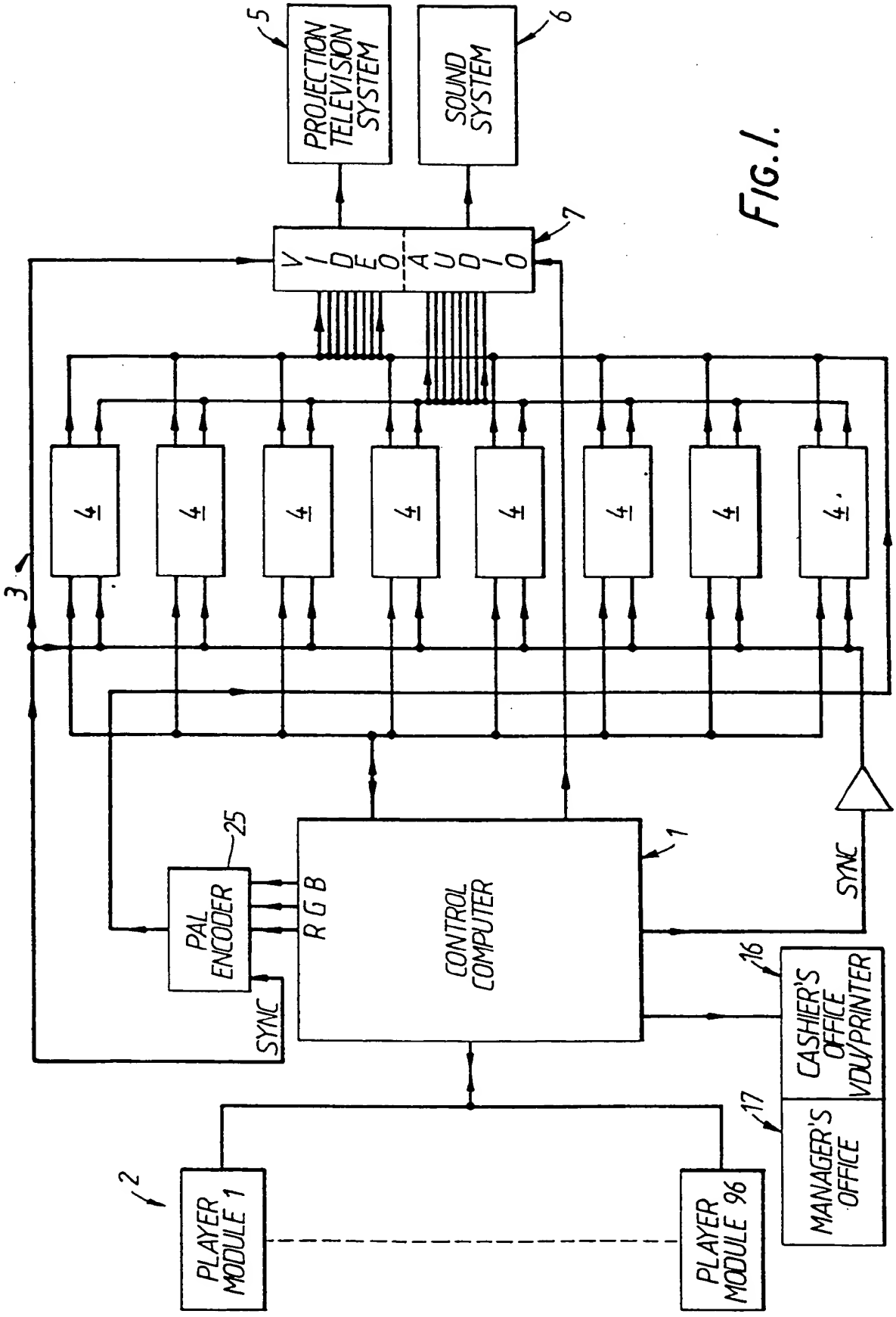
PROJECTION TELEVISION SYSTEM
SOUND SYSTEM
VIDEO AUDIO
4
3
PAL ENCODER
25
RGB
SYNC
CONTROL COMPUTER
1
SYNC
CASHIER'S OFFICE VDU/PRINTER
16
MANAGER'S OFFICE
17
PLAYER MODULE 1
PLAYER MODULE 96
2

FIG. 1.

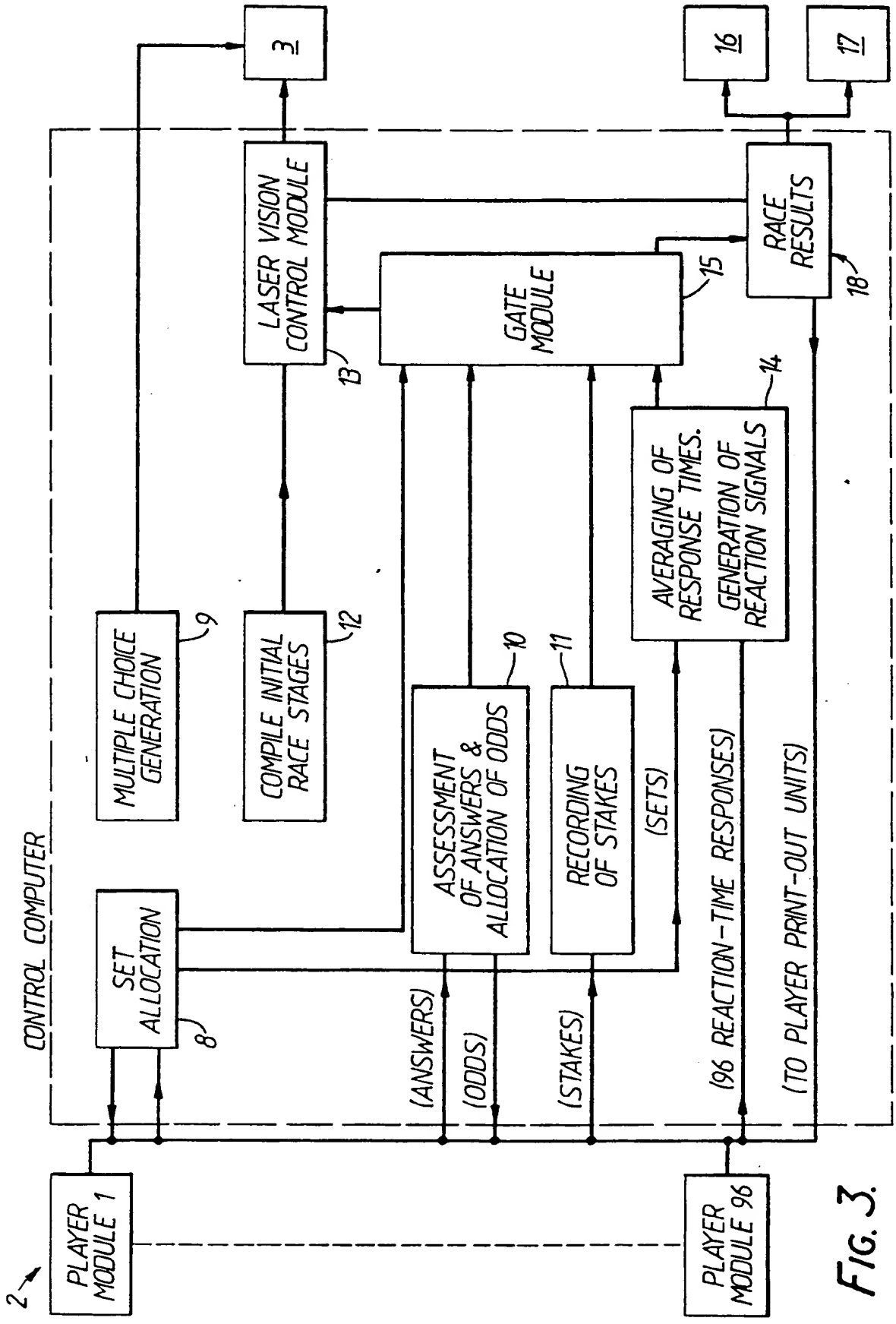
CONTROL COMPUTER
PLAYER MODULE 1
PLAYER MODULE 96
2
SET ALLOCATION
8
MULTIPLE CHOICE GENERATION
9
COMPILE INITIAL RACE STAGES
12
LASER VISION CONTROL MODULE
13
3
GATE MODULE
15
16
17
RACE RESULTS
18
ASSESSMENT OF ANSWERS & ALLOCATION OF ODDS
10
RECORDING OF STAKES
11
AVERAGING OF RESPONSE TIMES. GENERATION OF REACTION SIGNALS
14
(ANSWERS)
(ODDS)
(STAKES)
(SETS)
(96 REACTION-TIME RESPONSES)
(TO PLAYER PRINT-OUT UNITS)

FIG. 3.

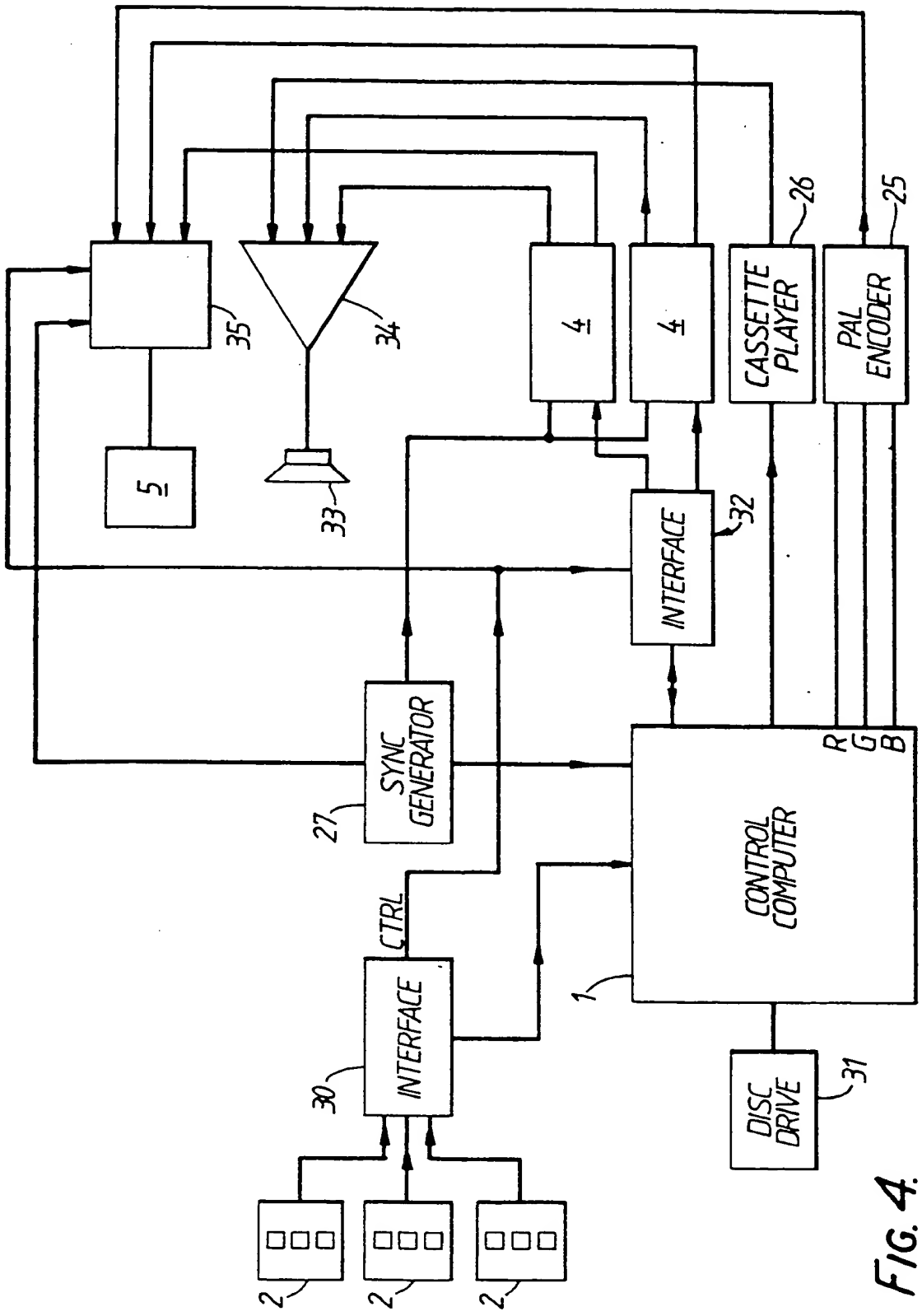

FIG. 4.

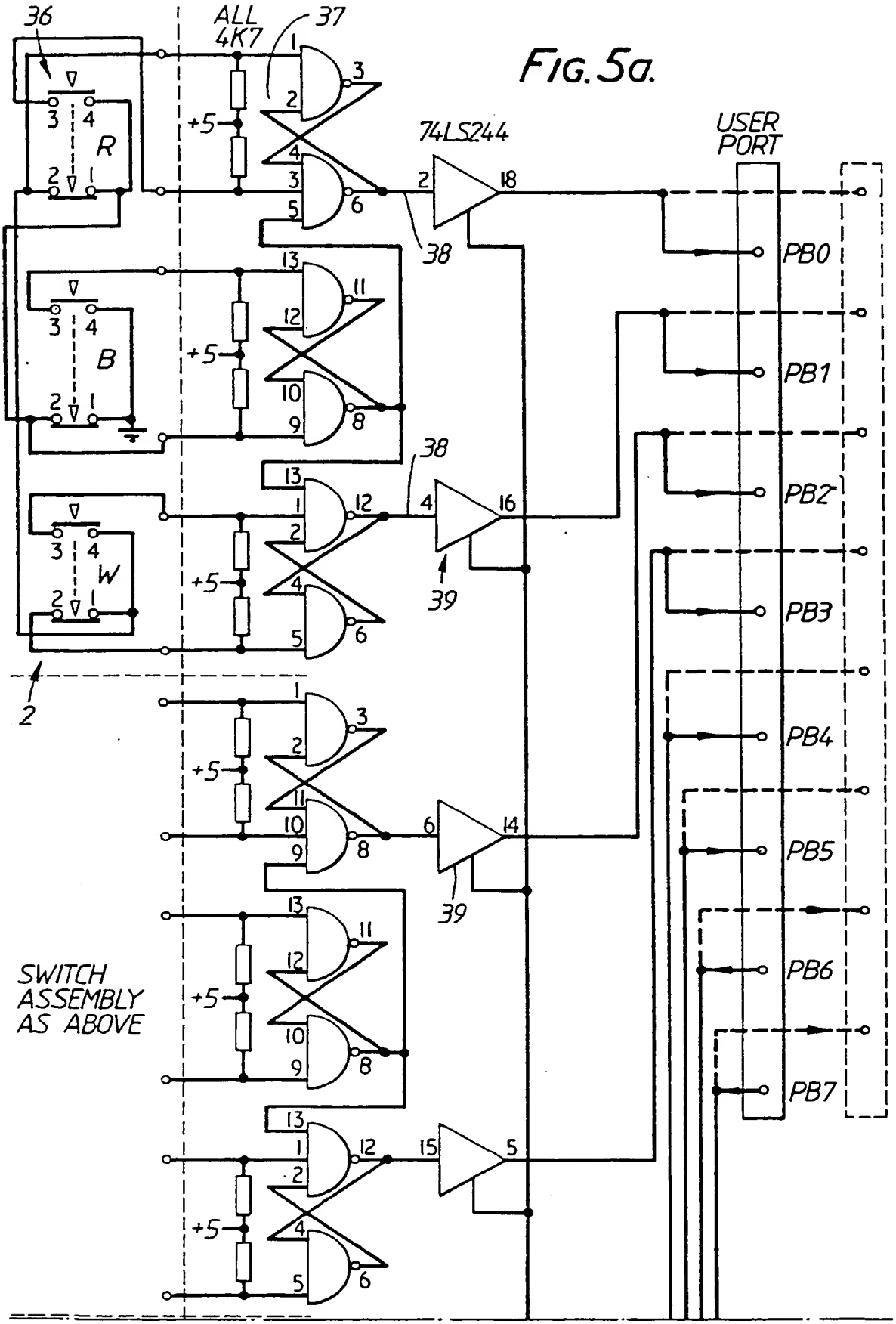
36
ALL 4K7
37
R
B
W
+5
74LS244
USER PORT
38
39
2
PB0
PB1
PB2
PB3
PB4
PB5
PB6
PB7
SWITCH ASSEMBLY AS ABOVE

Fig. 5a.

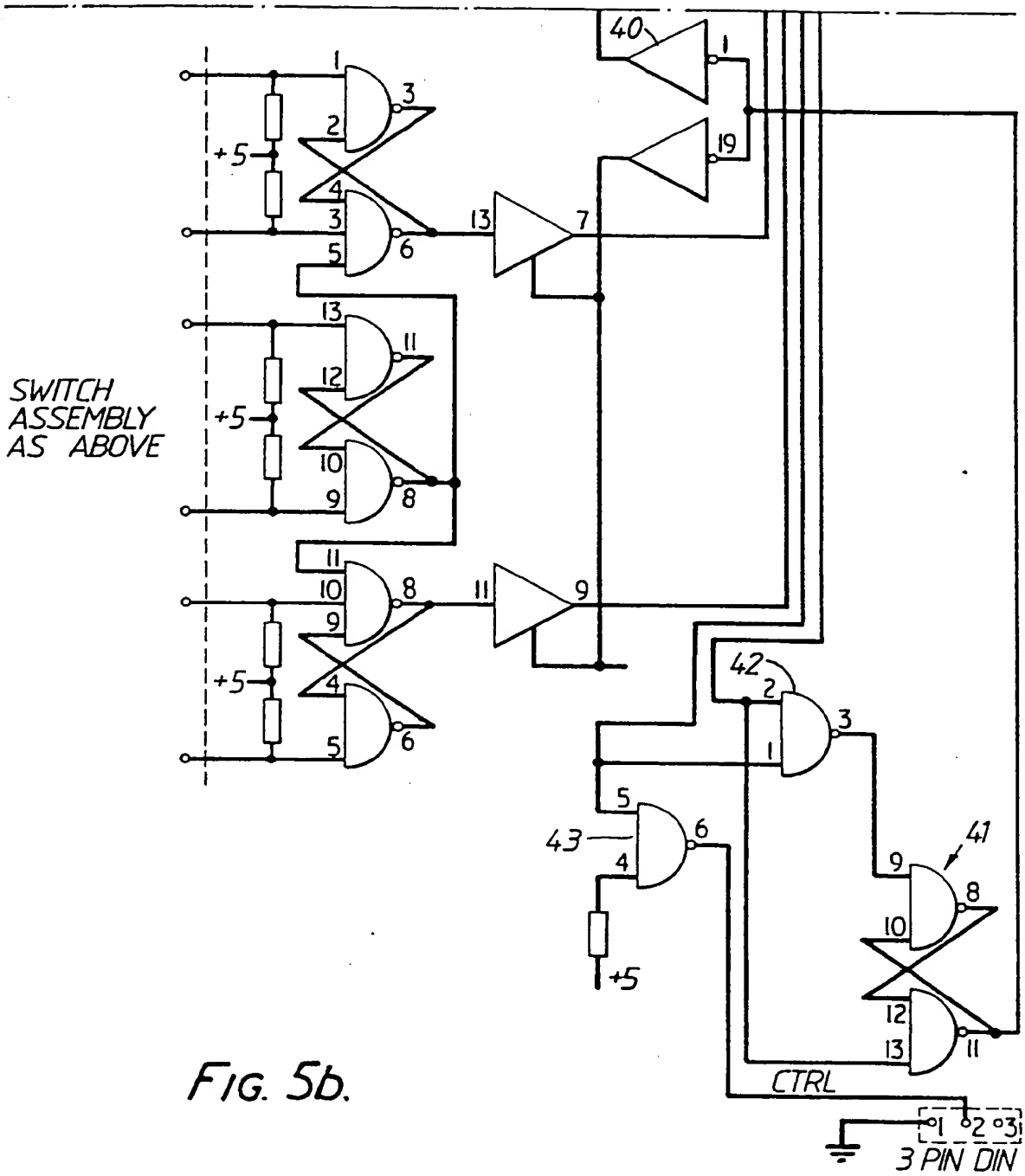

FIG. 5b.

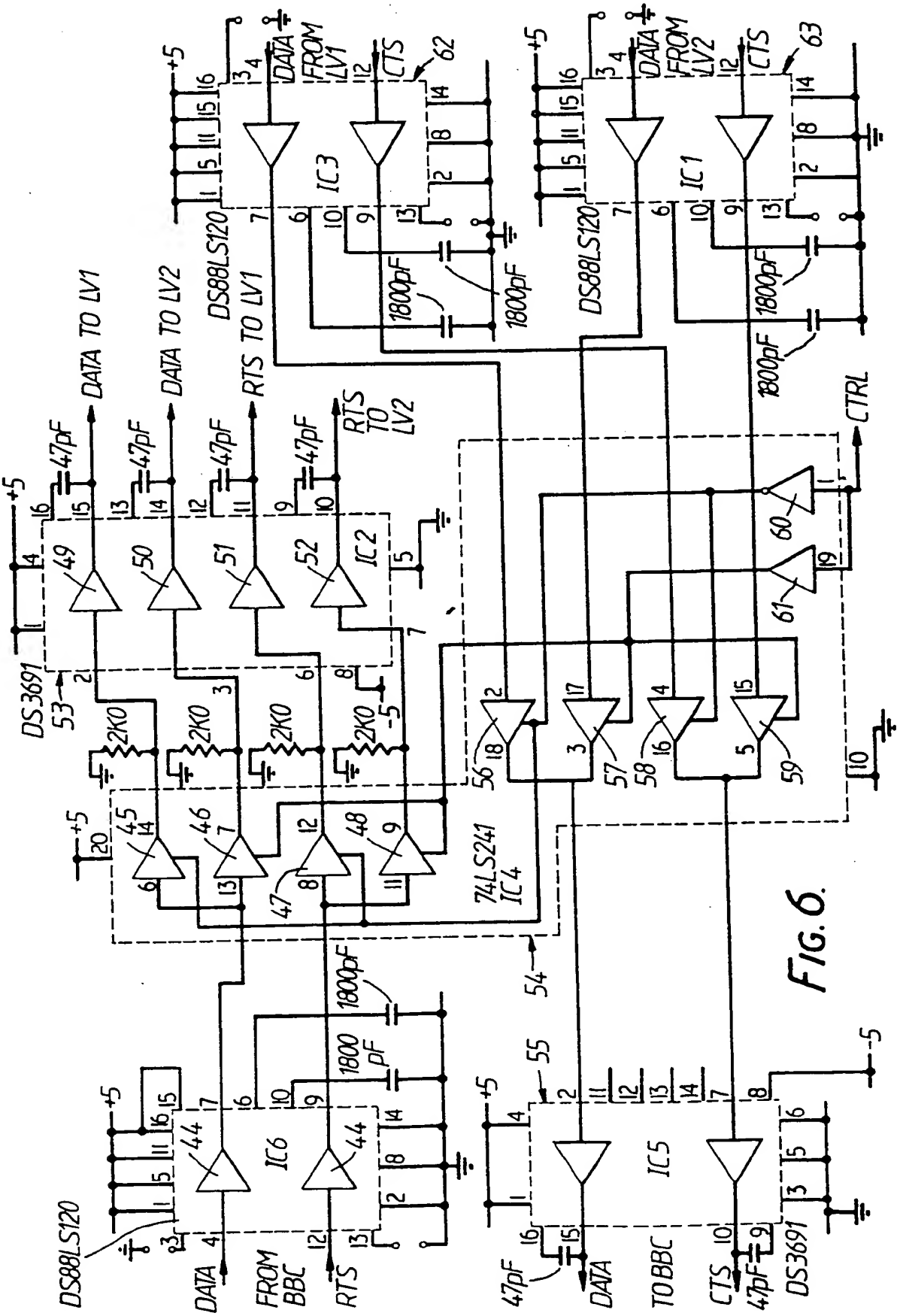

FIG. 6.

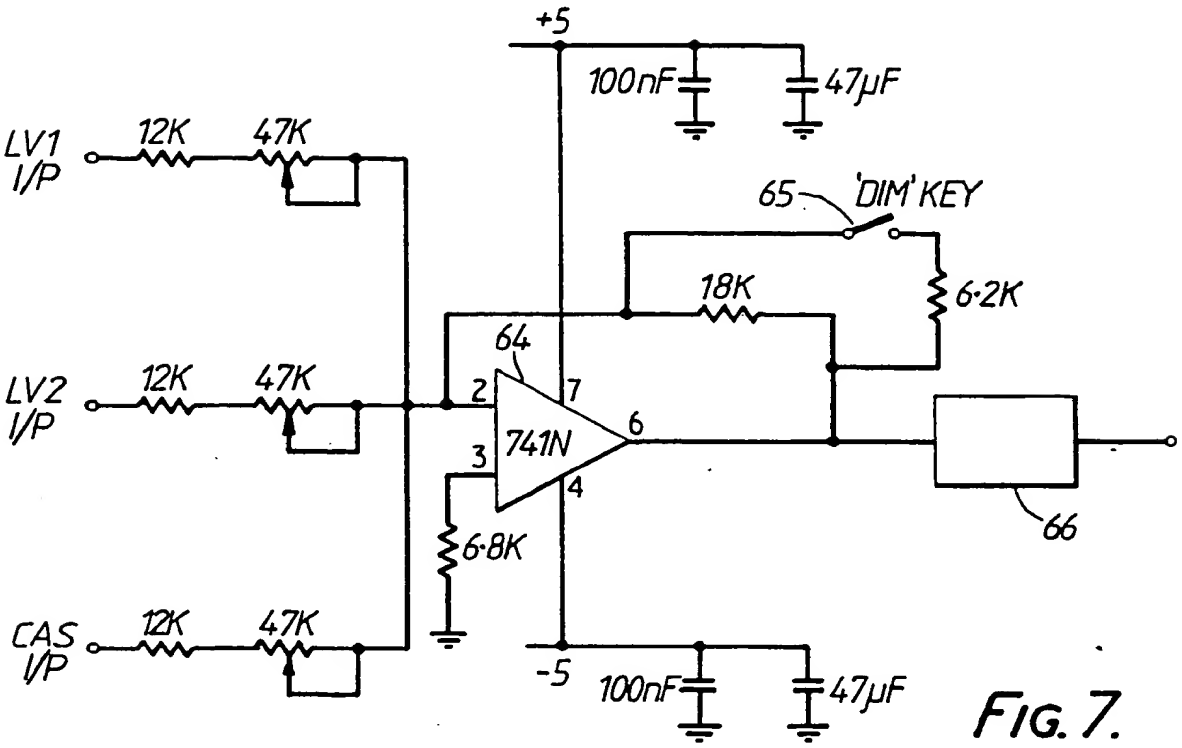
+5
100nF
47µF
LV1 I/P
12K
47K
65
'DIM' KEY
18K
6·2K
64
LV2 I/P
12K
47K
2
7
741N
6
3
4
66
6·8K
CAS I/P
12K
47K
-5
100nF
47µF

FIG. 7.

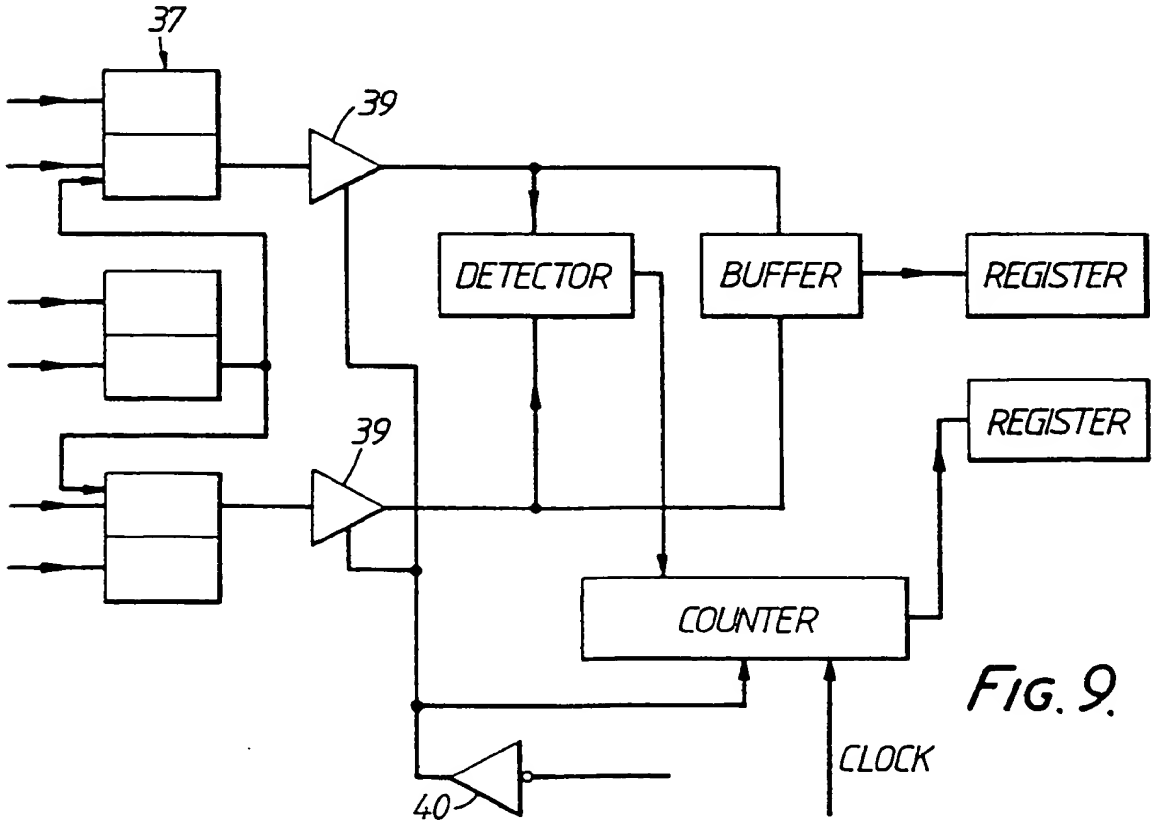
37
39
DETECTOR
BUFFER
REGISTER
39
REGISTER
COUNTER
CLOCK
40

FIG. 9.

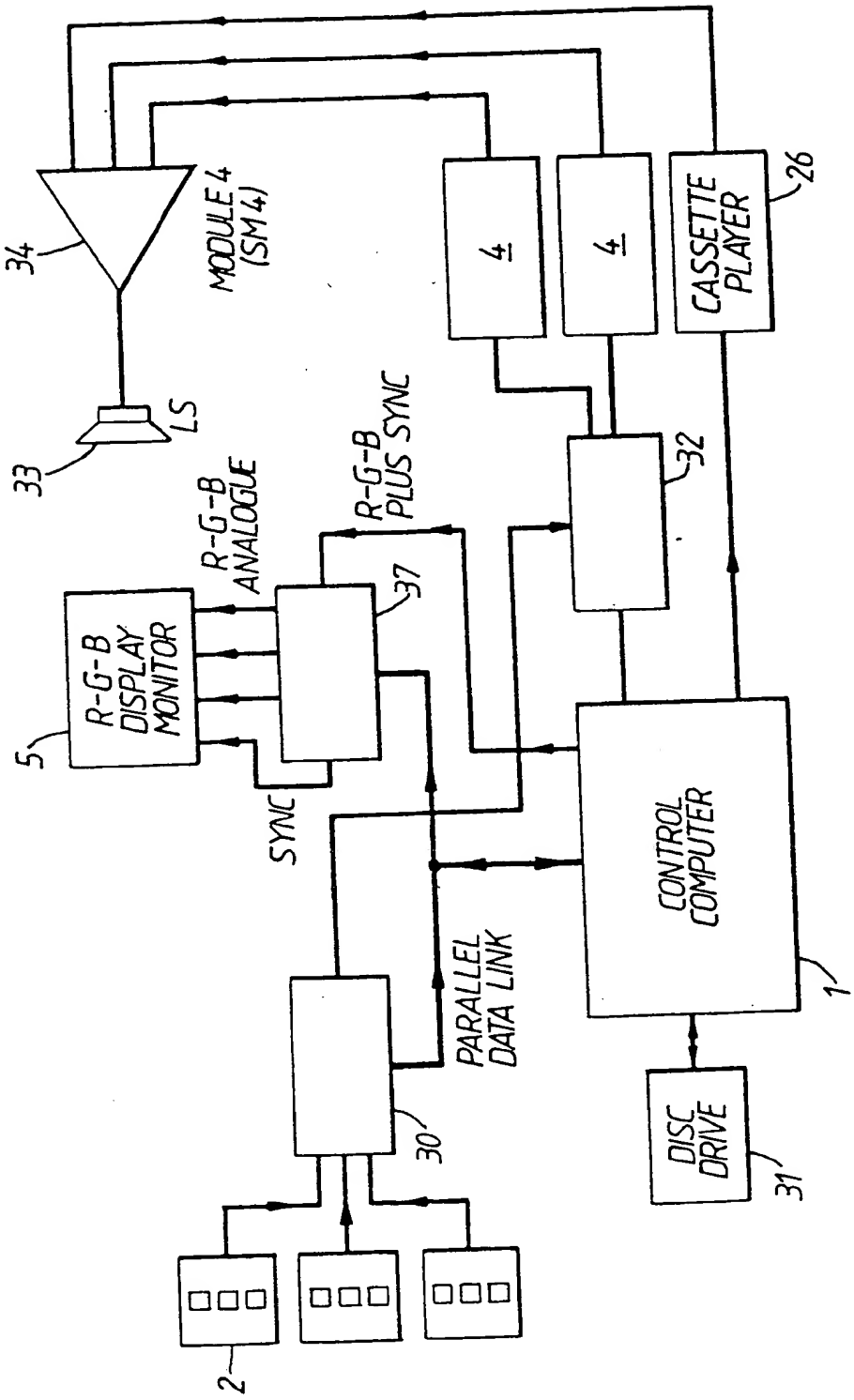
34
MODULE 4 (SM4)
LS
33
4
4
CASSETTE PLAYER
26
32
R-G-B ANALOGUE
R-G-B PLUS SYNC
37
R-G-B DISPLAY MONITOR
5
SYNC
CONTROL COMPUTER
1
PARALLEL DATA LINK
30
DISC DRIVE
31
2

FIG. 8.

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 85/00489

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[4]: G 06 F 15/44; A 63 F 9/14; A 63 F 9/22

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[4]	G 06 F 15/44 A 63 F 9/14 A 63 F 9/22 A 63 F 9/18

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with Indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	WO, A, 84/03792 (DYER) 27 September 1984, see page 3, lines 6-28; page 5, lines 4-21,33-36	1-9,12,17
Y	MC, A, 1074751016 (ELDER) 28 February 1975, see page 1, lines 1-23; page 7, line 11 - page 8, line 17	1,10,14, 15-17

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
16th January 1986	[illegible]
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	[illegible] VAN MOL

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX : THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/GB 85/00489 (SA 11081)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 04/02/86

The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO-A- 8403792	27/09/84	AU-A-	2814084	09/10/84
		EP-A-	0138968	02/05/85
MC-A- 1016	28/02/75	None		

For more details about this annex :
see Official Journal of the European Patent Office, No. 12/82

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